401 KAR 42:060

CORRECTIVE ACTION OUTLINE

ENERGY AND ENVIRONMENT CABINET
DIVISION OF WASTE MANAGEMENT
UNDERGROUND STORAGE TANK BRANCH
200 FAIR OAKS LANE, SECOND FLOOR
FRANKFORT, KENTUCKY 40601
502-564-5981

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CORRECTIVE ACTION OUTLINE

INTRODUCTION

This outline identifies required corrective action activities for releases from underground storage tank (UST) systems, including protocols for the following in accordance with 401 KAR 42:060:

- Statistical Analysis (Section 1)
- Conceptual Site Models (CSM) (Section 2)
- Feasibility Studies (Section 3)
- Pilot Studies (Section 4)
- Corrective Action Plans (CAP) (Section 5)

Soil screening levels prescribed in accordance with the Classification Outline or the screening levels in effect prior to April 18, 1994 may constitute final standards for no further action. However, residual contaminant concentrations in soil, which vary from the applicable screening levels, may be determined protective of human health and the environment by the cabinet, through a statistical analysis or upon a site-specific evaluation of potential exposure scenarios in relation to the fate and transport of residual levels of soil contamination.

Groundwater screening levels prescribed in accordance with the Classification Outline or the screening levels in effect prior to April 18, 1994 may constitute final standards for no further action. However, residual contaminant concentrations in groundwater, which vary from the applicable screening levels, may be determined protective of human health and the environment by the cabinet, through a site-specific evaluation of potential exposure scenarios in relation to the fate and transport of residual levels of groundwater contamination. This evaluation may include:

- Acceptable hydrogeologic testing to determine the yield or quality of the affected groundwater zone. If this testing determines that the yield is less than 150 gallons per day or that Total Dissolved Solids exceed 10,000 ppm, the cabinet may determine that the groundwater is not a current or potential source for domestic use;
- A determination of contamination migration between the upper and lower groundwater zones; and
- A determination of the stability of contamination within the impacted groundwater zone (i,e,. expanding, decreasing, stable).

Any report prepared in response to actions directed in accordance with this outline shall be completed and signed by a Professional Engineer (P.E.) licensed with the Kentucky Board of Licensure for Professional Engineers and Land Surveyors, or a Professional Geologist (P.G.) registered with the Kentucky Board of Registration for Professional Geologists.

The Corrective Action Monitoring Report Form, DEP8045 shall be utilized to report analytical data as directed in writing by the cabinet.

The eligible reimbursement of actions directed in accordance with this outline shall be made in accordance with 401 KAR 42:250. Field work or report preparation shall not be initiated prior to the issuance of a written directive by the Underground Storage Tank Branch. For questions regarding reimbursement, contact the UST Branch Claims and Payment Section at (502) 564-5981.

1.0 STATISTICAL ANALYSIS

Upon completion of site investigation activities to determine the extent of contamination, the cabinet

shall determine whether site-specific information is sufficient to enable the performance of a statistical analysis of analytical data for soil samples, as appropriate. This statistical analysis will determine whether individual soil sample data can be deemed statistically insignificant through a determination of the 95% Upper Confidence Limit (UCL). The spatial distribution of sample collection points will be considered to ensure that the full extent of soil contamination is evaluated, and additional soil sampling shall be directed to fill data gaps as needed. If the existing site-specific information is sufficient to determine that residual soil contamination statistically meets the criteria for no further action at UST facilities for which groundwater contamination above screening levels does not currently exist, a No Further Action (NFA) letter will be issued by the cabinet.

If an NFA letter is not issued for soil contamination through a statistical analysis, or if groundwater contamination currently exists above screening levels, the cabinet shall determine whether a Conceptual Site Model, a Corrective Action Plan, or other corrective action approaches are necessary in accordance with this outline.

2.0 CONCEPTUAL SITE MODELS (CSM)

If an NFA letter is not issued for soil contamination through a statistical analysis in accordance with Section 1.0 of this outline, or if groundwater contamination currently exists above screening levels, the cabinet shall determine whether a CSM is necessary. If the cabinet determines that a CSM is not necessary, further corrective actions shall be directed in writing by the cabinet.

The purpose of a CSM is to gather and integrate all relevant data and information to provide a foundation for the development of an overall corrective action strategy, and is typically associated with groundwater contamination. Upon the completion of a properly prepared CSM, a comprehensive understanding of site conditions shall have been acquired through records research and field reconnaissance, leading to detailed conclusions and substantial recommendations for future action.

The CSM may serve as the basis for:

- A no further action determination;
- Feasibility studies;
- Pilot studies;
- A site-specific Corrective Action Plan;
- The development of a risk assessment; or
- Other corrective action approaches deemed appropriate by the cabinet.

If the cabinet determines that the development of a CSM is necessary, the cabinet shall issue a written directive requesting P.E. or P.G. recommendations concerning additional data needed (e.g., additional soil borings, monitoring wells, vertical profile data, yield/pump tests, etc.), and necessary field reconnaissance required to adequately develop a comprehensive CSM in accordance with this outline (Preliminary CSM Data Information Proposal). Upon the cabinet's review of the submittal responding to the request for P.E. or P.G. recommendations, the cabinet shall issue a written directive to collect additional data, as necessary.

Upon or concurrent with the collection of additional data, the cabinet shall issue a written directive to develop a CSM.

During the development of a comprehensive CSM, further data gaps necessary to achieve its goal in facilitating the remedial strategy or no further action, that were not evident at the beginning of the CSM development, may arise and be identified by the P.G. before the completion of the CSM. These may include additional collection and integration of data by intrusive field efforts (e.g., deeper bedrock data via coring/monitoring wells, geophysical data, dye trace data, etc.).

If, during the development of a comprehensive CSM, further geologic, hydrogeologic, or other necessary data are recommended by the P.G. to adequately develop a comprehensive CSM, the cabinet shall issue a written directive to obtain the additional data upon concurrence in order to complete the CSM. If the cabinet issues a written directive to collect additional data, prior to the submittal of a CSM, an extension for the CSM report may be granted per request.

After the cabinet's determination of technical completeness of a submitted comprehensive CSM, in accordance with the findings of the CSM and the Conclusions and Recommendations section of the CSM concurred with by the cabinet, the cabinet may direct one or more of the following as deemed appropriate:

- Feasibility study;
- Pilot study;
- Corrective actions, as necessary.

If the cabinet determines that no further action is necessary upon submittal of the CSM, the cabinet may issue a No Further Action letter.

CSM REPORT FORMAT

The format below details the requirements in preparing a CSM report with corresponding sectional breakdowns. A response to each section below shall be provided and will determine technical completeness of the CSM report for the purpose of eligible reimbursement. If a particular section is not applicable to a specific UST facility, an explanation of the inapplicability shall be provided. The CSM shall include documentation of due diligence efforts to fully address each sectional breakdown included below. For example, if conclusions in the CSM assert that there are potential sources of off-site contamination contributing to the contaminant plume, then the CSM shall include the documentation of due diligence efforts (PVA search, library research, etc.) made to verify potential off-site sources of contamination.

"Section 1" - EXECUTIVE SUMMARY

- Provide a concise, general summary of the CSM report findings and recommendations.

"Section 2" - SITE AND AREA DESCRIPTION

- Identify and provide a description of the immediate and local land use.
- Identify and provide a description of the immediate and local public, private, surface and subsurface water use.
- Identify and provide a description of reasonable likely potential receptors.
- Identify and provide a description of other potential anthropogenic or natural sources of like contaminants of concern as applicable.
- As applicable, identify and provide a description of other pertinent and relevant information relating to a description of the site and local area.

"Section 3" - CHRONOLOGY OF EVENTS

- Provide an historic numerical or bulleted chronology of events related to the site up to the present site status. This will include, as applicable, but is not limited to:
    - the release scenario(s) (identify contaminants of concern, location(s), the date, duration, source of the release, existing delineation, migration routes and

mechanisms),
- history of prior releases,
- a description of other DEP program involvement,
- present status of any tanks,
- a description of known receptors that have been impacted (as applicable).
- interim measures, removals or engineering controls (provide, as applicable, a description of any previous source removals and the remediation of migration pathways),
- present status of property use and historic changes,
- present property size and historic changes,
- present ownership and historic changes,
- adjacent property present status and historic changes,
- physical land alterations, etc.

"Section 4" - SITE GEOLOGY, STRATIGRAPHY AND HYDROGEOLOGY

The P.E. or P.G. shall utilize professional judgment to identify the scope of geologic investigation necessary to address the following items in relation to the UST facility.

- Provide a description of the regional geology, stratigraphy, hydrogeology and surface water hydrology based upon current scientific publications and regional conditions.

- Provide a description of the local and site geology, stratigraphy, hydrogeology and surface water hydrology based upon current site conditions and accumulated data including lithologic, soil and/or unconsolidated material logs. Soil boring logs shall include a description of soil lithologies, lenses or thin layers encountered, the presence or absence of water and free product, and the depth of water and product if encountered. All soil and unconsolidated lithological logging shall be completed by utilizing the Unified Soil Classification System (USCS). The USCS is a soil classification system, used in engineering and geology professions, to give field guidance to consistently and objectively determine and describe the texture, grain size and other pertinent properties of a soil or unconsolidated sediment.

  Note: Local and site conditions may be assessed by examining local rock exposures and road cuts; on-site and off-site reconnaissance; information obtained during previous soil boring and monitoring well drilling activities; and professional judgment of the P.E. or P.G.

- Provide a discussion of the groundwater yield determination, if performed.

- If groundwater is impacted above prescribed screening levels at the soil and bedrock interface, discuss and justify the benefit of evaluating the groundwater within the bedrock.

- If the site is located in a carbonate bedrock setting:

  - Provide a discussion of the geologic factors, as applicable, regarding the site-specific geologic setting including, permeability, grain size, homogeneity, heterogeneity, consolidation, etc.;

  - Provide documentation indicating that a hydrogeologic survey was conducted, identifying all relevant karst features such as sinkholes, sinking streams, caves, and springs in the locale surrounding the site. If available, include a summary of applicable research from published information, dye trace studies, karst and dye tracing data base information, and field reconnaissance. Contact the Kentucky Division of Water at (502) 564-3410 to obtain any existing information on carbonate bedrock drainage near the site;

- Provide a discussion of the specific type(s) of karst flow at and surrounding the site. This may range from diffuse flow to pipe flow (e.g., bedding plane parting and interstitial, fracture, fissure network, small conduit and/or enlarged fissure, medium to large conduit). Discuss the type of karst dispersion at and surrounding the site. This may range from proximate to extensive (e.g., localized, linear, bidirectional, widespread, radial). Discuss the type of karst recharge at, around, down gradient and up gradient of the site. This may range from converging to dispersing (e.g., sinking streams, sinkholes, depressions, enlarged fractures, fracture and joint, tight fractures and inter granular); and

- Provide a discussion, specifically related to the site, describing the horizontal and vertical interconnected and interacting dynamics between various hydrogeologic zones (e.g., soil, soil/bedrock interface, bedrock) as specifically related to contaminant fate and transport within these zones. This discussion must consider the past release scenario, any subsequent interim measures, and primary and secondary source removals in order to provide the fate and transport dynamics that have led to the present status of the site.

"Section 5" - WELL AND WELL HEAD PROTECTION AREA SURVEY

- Provide a discussion of the inter-relationship between water-bearing zones associated with any domestic-use wells, domestic-use springs and domestic-use cisterns previously determined during site classification activities, identified within the Groundwater Classification Guide, and associated applicable Groundwater Table screening levels and water-bearing zones encountered at the UST facility.

- UST facilities eligible for the regulations in place prior to April 18, 1994, that are not required to classify the UST system in accordance with 401 KAR 42:080, shall provide a discussion of the inter-relationship between water-bearing zones associated with any domestic-use wells, domestic-use springs and domestic-use cisterns, identified within 300-meters, and water-bearing zones encountered at the UST facility.

- Indicate whether the site is located within a wellhead protection area as required under 401 KAR 5:037 Groundwater protection plans based on current well head protection area records.

"Section 6" - CONDUIT SURVEY

- Provide a discussion of confirmed natural or anthropogenic preferential conduit pathways identified, if applicable (i.e. below grade utility trenches, sewer lines, foundations, etc.).

"Section 7" – CONTAMINANT MASS CALCULATIONS AND DISTRIBUTION

- Provide a discussion of the current contaminant mass and spatial distribution (vertical and horizontal), based on Figures 1-8, 1-9, 1-10, 4, and 5 in the saturated, unsaturated soils and groundwater.

    - Groundwater contaminant mass shall be based on the most recent groundwater analytical data. Data shall not be more than two (2) years old.

    - Soil, saturated and unsaturated, shall be based on most recent analytical data gathered. Data shall not be more than five (5) years old and horizontal and vertical spacing shall provide sufficient coverage of the impacted area.

- Provide total mass calculations based on the average concentration(s) of a representative individual and/or combined constituent of concern (e.g. Benzene, total BTEX, total PAH,

other) and broken down as follows:

- An estimation of current free product contaminant mass.
- An estimation of current adsorbed contaminant mass in unsaturated soils.
- An estimation of current adsorbed contaminant mass in saturated soils.
- An estimation of current dissolved phase mass in groundwater.
- An estimation of the total contaminant mass as a sum of the soil (unsaturated and saturated) and groundwater mass.

"Section 8" – CONSTITUENTS OF CONCERN DISSOLVED PHASE TREND ANALYSIS

- If groundwater is impacted, graph site-specific concentration versus time. Calculate first order rate natural attenuation constants for concentration versus time of the dissolved phase for each monitoring well with impacted groundwater. Estimate, based on extrapolation or calculation, the time required for groundwater to reach corrective action goals by natural attenuation.

  NOTE: The first order rate natural attenuation calculation for concentration versus time may be performed by self developed calculating methods based on EPA's Groundwater Issue paper, EPA/540/S-02/500, "Calculation and Use of First-Order Rate Constant's for Monitored Natural Attenuation Studies," by Newell, Rifai, Wilson, Connor, Aziz and Suarez, November 2002; or by utilizing a program or workbook that can perform this calculation (e.g. the Excel workbook MNADecayRateCalcs available at http://waste.ky.gov/ust).

- If groundwater is impacted, graph site-specific concentration versus distance. In order to approximate the contaminant movement in groundwater over distance and time, calculate first order rate natural attenuation constants for concentration versus distance of the dissolved phase for monitoring wells along the long and short axis of the plume in the downgradient direction, or other appropriate configuration in the downgradient direction, based on professional judgment for at least three different sampling dates. Estimate the distance attenuation by extrapolation of the concentration versus distance plots to below Groundwater Table 1 screening levels. Calculations and extrapolations are to be made as to whether the plume is exhaustibly-expanding (source removed), inexhaustibly-expanding (source remaining), stable or decreasing. Provide a discussion of the present mobility or plume stability of the dissolved mass release (e.g., is plume exhaustibly-expanding, inexhaustibly-expanding, stable, decreasing). Include in the discussion any known attenuation processes occurring.

  NOTE: The first order rate natural attenuation calculation for concentration versus distance may be performed by self developed calculating methods based on EPA's Groundwater Issue paper, EPA/540/S-02/500, "Calculation and Use of First-Order Rate Constant's for Monitored Natural Attenuation Studies," by Newell, Rifai, Wilson, Connor, Aziz and Suarez, November 2002; or by utilizing a program that can perform this calculation or similar modeling (e.g. the BIOSCREEN Natural Attenuation Decision Support System Version 1.4 based on the Domenico model).

- Provide a discussion if and how active corrective action technologies may enhance or surpass natural attenuation to achieve corrective action goals (i.e., time trends for monitored natural attenuation only versus future time projections through the application of various technologies and multiphase remedial strategies).

"Section 9" –PRELIMINARY TECHNOLOGY SCREENING

Provide a comprehensive discussion of the scientific viability of various technologies that may

be used as an individual remedial approach or as part of an overall remedial strategy based on site-specific geologic factors that shall include but not be limited to;

- Permeability;
- Grain size;
- Heterogeneity;
- Consolidation; and

If the site is located in a carbonate bedrock setting, the technology screening shall consider the following:

- The type of karst flow at and surrounding the site ranging from diffuse to pipe (e.g., bedding plane parting and interstitial, fracture, fissure network, small conduit and/or enlarged fissure, medium to large conduit).
- The type of karst dispersion at and surrounding the site ranging from proximate to extensive (e.g., localized, linear, bi-directional, widespread, radial).

- Other factors that require consideration include, but are not limited to:

  - Financial limitations;
  - UST facility owner business concerns;
  - Physical site restrictions; and
  - Local restrictions.

"Section 10" – OTHER RELEVANT DATA AND INFORMATION (Optional Section)

- Based on professional judgment (i.e., scientific knowledge and conjecture) provide a narrative of other relevant data and information.

"Section 11" – CONCLUSIONS AND RECOMMENDATIONS

Provide conclusions and recommendations (e.g., feasibility study, pilot study, corrective actions, no further action, etc.) based upon the gathering, integrating and synthesizing of the data and information within this CSM and professional judgment (i.e., scientific knowledge and conjecture).

Conclusions and recommendations shall be comprehensive, and shall include the following:

- A detailed discussion as to whether the groundwater encountered constitutes a current or potential source for domestic use through an evaluation of the quantity of the impacted groundwater zone.
- A discussion of potential contaminant migration between the upper and lower groundwater zones.
- A detailed discussion of the inter-relationship between soil and groundwater contamination, including fate and transport conclusions, migration pathways and receptors.
- A detailed discussion of the stability of contamination within the impacted groundwater zone (i,e,. expanding, decreasing, stable), and any factors that may affect the stability of the impacted groundwater zone.
- Include a discussion of comparative technologies, the recommended technologies and the basis for the recommendation.
- Provide a discussion of recommendations, if identified, for additional study information needed to evaluate specific remedial strategies (e.g. feasibility study, pilot study).

"Section 12" - REFERENCES

Include a list of all reference material utilized in the development of this report.

"Section 13" – FIGURES

- **"Figure 1-1"** – Provide an aerial photograph indicating the location of the site at the same scale (or as approximate as available).

- **"Figure 1-2" -** Provide the most recent site survey map that includes an accurate location of utilities.

- **"Figure 1-3"** - Provide a site map illustrating historic soil sampling locations.

- **"Figure 1-4"** - Provide a site map illustrating historic and currently existing wells. A different symbol should be used for historic wells that no longer exist. (e.g., destroyed, abandoned, etc.)

- **"Figure 1-5"** - Provide a site map indicating all excavation area(s), depth of each excavation, material used for backfill, existing ground cover and sampling locations within each excavation area, as applicable.

- **"Figure 1-6**" - Provide a site map indicating all known historic (i.e., no longer present) and existing sources of contamination (e.g., tanks, tank pits, piping, residual/secondary source).

- **"Figure 1-7"** - Provide a site map indicating the most recent potentiometric surface and illustrating the general groundwater flow trend on the basis of an evaluation of the historic potentiometric surface maps, if applicable.

- **"Figure 1-8"** - If applicable, provide a groundwater Isoconcentration Contour Map for the site based on a representative individual and/or combined constituent of concern (e.g. Benzene, total BTEX, total PAH, other).

- **"Figure 1-9"** - Provide a contaminant Isoconcentration map for each soil horizon sampled and analyzed based on a representative individual and/or combined constituent of concern (e.g. Benzene, total BTEX, total PAH, other).

- **"Figure 1-10"** - Provide a contaminant extent map for groundwater, if applicable.

- **"Figure 2" -** Provide the portion of the 7.5-minute USGS (United States Geological Survey) Topographic Map depicting the location of the site. The portion of the Topographic Map submitted shall indicate the name of the map, latitude and longitude labels, and a map scale.

- **"Figure 3" -** Provide the portion of the 7.5-minute USGS Geologic Quadrangle Map depicting the location of the site. The portion of the Geologic Quadrangle Map submitted shall indicate the name of the map, latitude and longitude labels, and a map scale. Provide a description of site geology from the geologic quadrangle.

- **"Figure 4"** - Provide a geologic cross section along the long axis of the contaminant plume indicating the following:

    - the map location of the boreholes along the cross-section(s) from which the geologic data were obtained;
    - correlation of the geologic information between borehole data points;
    - free phase hydrocarbons;
    - absorbed soil mass identifying contaminant concentrations;
    - dissolved phase plume identifying contaminant concentrations;
    - soil and lithological stratigraphy;

- recent depth to groundwater elevations; and
- other pertinent subsurface features (tank pits, underground utilities, monitoring wells, soil borings, etc.);
- the horizontal map scale;
- the vertical exaggeration scale;
- all elevations (e.g. land, monitoring well, ground water, etc.);
- a legend into the cross-section to explain the types of geologic materials present; and
- appropriate orientations and landmark information to help the viewer relate to the cross sections position in space relative to recognizable features (buildings, streets, streams, etc.).

- **"Figure 5"** - Provide a geologic cross section along the short axis of the contaminant plume indicating the following:

    - the map location of the boreholes along the cross-section(s) from which the geologic data were obtained;
    - correlation of the geologic information between borehole data points;
    - free phase hydrocarbons;
    - absorbed soil mass identifying contaminant concentrations;
    - dissolved phase plume identifying contaminant concentrations;
    - soil and lithological stratigraphy;
    - recent depth to groundwater elevations; and
    - other pertinent subsurface features (tank pits, underground utilities, monitoring wells, soil borings, etc.);
    - the horizontal map scale;
    - the vertical exaggeration scale;
    - all elevations (e.g. land, monitoring well, ground water, etc.);
    - a legend into the cross-section to explain the types of geologic materials present; and
    - appropriate orientations and landmark information to help the viewer relate to the cross sections position in space relative to recognizable features (buildings, streets, streams, etc.).

- **"Figure 6"** - Provide a site bedrock contour map (if applicable).

- **"Figure 7"** - Provide hydrographs for all monitoring wells for trend analysis (i.e., hydraulic elevation versus time plots).

- **"Figure 8"** - Provide concentration versus time plots for each monitoring well or other groundwater monitoring point(s) for trend analysis.

- **"Figure 9"** - Provide concentration versus distance plots for trend analysis.

"Section 14" - TABLES

"Table 1" - Provide a groundwater elevation data table for all historic and existing monitoring wells (See Figure 2 of the Site Investigation Outline, December 2010). This table shall include:

- all current and historic gauging data for each monitoring well;
- monitoring well identification numbers;
- groundwater gauging dates; and
- identification of abandoned wells.

"Table 2" - Provide a groundwater analytical data table for all historic and existing monitoring wells (See Figure 3 of the Site Investigation Outline, December 2010). This table shall include:

- all current and historic analytical data for each monitoring well (indicating appropriate units);
- monitoring well identification numbers;
- sample collection dates; and
- identification of abandoned wells.

"Table 3" - Provide a soil analytical data table for all soil samples previously collected, if applicable (See Figure 1 of the Site Investigation Outline, December 2010). This table shall include closure samples, soil samples collected during monitoring well installation, soil borings, confirmation samples and shall include the following information:

- sample identification number;
- depth sampled;
- date sampled;
- analytical results (indicating appropriate units);
- identification of soil samples representing the resampling of an area previously sampled; and
- identification of historic soil samples from soil borings removed during over-excavation.

"Table 4" - Provide a historical data table that summarizes construction of monitoring wells. This table shall note if status of the well if abandoned, lost, or destroyed and shall include the following information:

- monitoring well name;
- AKGWA #;
- top-of-casing elevation in feet;
- well diameter in inches;
- total depth in feet;
- depth to top of screen in feet;
- depth to bottom of screen in feet;
- depth to water in feet (historical range);
- water surface elevation in feet (historical range); and
- comments.

APPENDICES

"Appendix A" - Provide current site and adjacent property photographs.

"Appendix B" - Provide copies of all boring logs.

"Appendix C" - Provide copies of all monitoring well records, include abandoned monitoring wells.

"Appendix D" - Provide copies of all potentiometric surface maps.

3.0 FEASIBILITY STUDY

If a recommendation from the P.E. or P.G. is made for a feasibility study at the conclusion of the CSM, or if deemed necessary by the cabinet, the cabinet may send a written request for a feasibility study prior to requiring the submittal of a CAP. The parameters included in the request for a feasibility study shall be based on site-specific information, the technologies under consideration, and the media impacted above screening levels. For UST facilities undertaking a feasibility study, the following may be required:

Field Instrument Measurements for Groundwater

- pH
- Temperature
- Dissolved Oxygen
- Oxidation-Reduction Potential
- Conductivity

Other Measurements for Soil and Groundwater

- Yield Test
- Pump Test
- Slug Test
- Grain Size Analysis

Laboratory Measurements for Soil

- Soil Moisture Content
- Intrinsic Soil Permeability
- Total Organic Carbon
- Soil oxidation-reduction potential

Laboratory Measurements for Groundwater

- Chloride
- Dissolved CO2
- Bicarbonate Alkalinity
- Phosphate
- Carbonate Alkalinity
- Sulfate
- Nitrate/Nitrite
- Sulfide
- Biological Oxygen Demand
- Total Chemical Oxygen Demand
- Microbe Enumeration Studies
- Total Petroleum Hydrocarbon
- Total Dissolved Solids
- Total Organic Nitrogen
- Total Dissolved Solids
- Inorganic Nitrogen
- Total Iron
- Manganese
- Dissolved Iron
- Dissolved Magnesium
- Calcium

The Feasibility Study Report shall include a summary that describes sample locations, extraction locations, monitoring locations, sampling methodology, an evaluation of field and laboratory data, and shall include drawings, maps and conclusions. The Feasibility Study Report shall also include a discussion of comparative technologies, the recommended technologies and the basis for the recommendation. If the conclusions section of the Feasibility Study Report includes a recommendation for a pilot study, a proposal shall be included.

Note that sample collection via bailing may not be appropriate for some field measurements. Direct measurement devices (down-hole probes) or flow-through measurement instruments (flow-through cells) and low-flow pumps may be used to more accurately and reliably characterize groundwater.

4.0 PILOT STUDIES

The cabinet may, on the basis of P.E. or P.G. recommendations or as otherwise deemed necessary, direct in writing that a pilot study be performed. A pilot study is a smaller scale study of the expected remedial technology or strategy to confirm effectiveness before implementing full scale. A pilot study is not a test of multiple technologies in order to determine which may or may not be effective.

For owners/operators seeking reimbursement from the cabinet for a pilot study, written approval from the cabinet shall be obtained prior to beginning a pilot study.

A Pilot Study Report shall be submitted upon completion of the pilot study. The Pilot Study Report shall include a summary of the pilot study, all field and laboratory data collected during the pilot study, as well as conclusions based on the data, and recommendations for corrective action.

5.0 CORRECTIVE ACTION PLANS (CAP)

This section is provided to assist owners or operators in the development and implementation of a Corrective Action Plan (CAP).

The cabinet shall consider a recommendation from the P.E. or P.G. to initiate an assessment of risk associated with residual levels of contamination above the screening levels prescribed in accordance with the Classification Outline. Additionally, the cabinet may direct in writing that an assessment of risk associated with residual levels of contamination above the screening levels prescribed in accordance with the Classification Outline be developed.

If the remedial action plan for a UST facility consists only of a Risk Assessment, the development of a Corrective Action Plan as outlined below shall not be required, and the Underground Storage Tank Branch shall direct appropriate actions accordingly.

The approval of a Corrective Action Plan shall be based upon the cabinet's evaluation of site-specific conditions and consideration of P.E. or P.G. recommendations.

The format below details the requirements in preparing a Corrective Action Plan report with corresponding sectional breakdowns. A response to each section below shall be provided and will determine technical completeness of the CAP report for the purpose of eligible reimbursement.

"Section 1" - Executive Summary

Provide a summary of CSM conclusions. If a CSM was not directed in writing by the cabinet, provide a summary of Site Investigation information.

"Section 2" - Remedial Goals for the UST Facility

Provide the site-specific screening levels for soil and/or groundwater as prescribed in accordance with the Classification Outline that was utilized for the purpose of site investigation. Discuss and give justification as to these levels becoming final cleanup goals or justification for site specific alternative clean up goals based upon the findings of the CSM or other site specific information. Include an estimated timetable for the implementation of the CAP, approximate start up time, and achieving intermediate and final corrective action objectives.

"Section 3" - Detail Design Plans

Provide a schematic summary of the design and operation of the selected technology (or technologies), including a description of equipment, operating and monitoring requirements, ground layout (proposed location of monitoring wells, extraction wells, injection wells, etc.), and methods used to control discharges of air and/or water. This shall be a working conceptual plan and not an "as built" design.

Provide a list of all permits required for the project, and the contacts necessary to obtain these permits.

Provide a discussion of all hazardous and solid waste disposal issues produced by the remedial technology.

"Section 4" –Technology Monitoring

Summarize and discuss the measurements associated specifically with the treatment system (e.g., influent/effluent measurements, stack testing, pass-through flow velocity, etc.) that will be utilized to monitor the effectiveness of the selected technology (or technologies).

"Section 5" - Specific Data Elements used to Monitor Remedial Effectiveness

Provide a description of the parameters in soil and/or groundwater to be sampled (e.g., contaminant concentrations, soil-gas, soil pore water and groundwater chemistries such as pH, Eh, O_2, COD) or other methods for determining corrective action efficacy at the site.

"Section 6" - Monitoring Remedial Effectiveness

Provide a schedule for sampling selected parameters for affected media, including target contaminant concentrations, on a frequency sufficient to determine changes in contaminant levels and potential or real plume migration, including post-remedial monitoring.

"Section 7" - Figures

- **"Figure 1" -** Provide a map that illustrates the footprint of the contaminated area in conjunction with the footprint of the proposed remedial approach. It may be necessary to include additional maps to provide a detailed illustration of each component of the entire remedial approach.

- **"Figure 2"** - Provide a geologic cross section along the long axis of the contaminant plume indicating the following, as applicable:

    - free phase hydrocarbons;
    - absorbed soil mass identifying contaminant concentrations;
    - dissolved phase plume identifying contaminant concentrations;
    - soil and lithological stratigraphy;
    - recent depth to groundwater elevations;
    - other pertinent subsurface features (tank pits, underground utilities, monitoring wells, soil borings, etc.); and
    - proposed injection depths, extraction depths, estimated zone of influence, etc.

- **"Figure 3"** - Provide a geologic cross section along the short axis of the contaminant plume indicating the following, as applicable:

    - free phase hydrocarbons;
    - absorbed soil mass identifying contaminant concentrations;
    - dissolved phase plume identifying contaminant concentrations;
    - soil and lithological stratigraphy;
    - recent depth to groundwater elevations;
    - other pertinent subsurface features (tank pits, underground utilities, monitoring wells, soil borings, etc.); and
    - proposed injection depths, extraction depths, estimated zone of influence, etc.

- **Other Figures** – Provide other remedial strategy or technology figures and schematics as needed to give sufficient explanatory detail based on the professional judgment of the P.E. or P.G. or as requested by the Cabinet.

6.0 PUBLIC NOTICE REQUIREMENTS

- Prior to the implementation of a CAP, the owner or operator shall give notice of the proposed action by publishing at least one time, a Public Notice in a newspaper having general circulation in the county where the corrective action is to take place. Submit one copy of the invoice, and an affidavit of publication to the Division of Waste Management, Underground Storage Tank Branch within seven (7) days after publication. An example of the Public Notice that shall be completed and published is included below.

EXAMPLE PUBLIC NOTICE

Kentucky Department for Environmental Protection
Division of Waste Management
Underground Storage Tank Branch
200 Fair Oaks Lane, Second Floor
Frankfort, Kentucky 40601

NOTIFICATION OF PROPOSED CORRECTIVE ACTION PLAN

The _____ (site name and Agency Interest number), located at _____ (address: street, city, county, Kentucky) has proposed a plan to clean up _____(type of contaminant) contamination from the _____(impacted media).

Due to a UST system release of _____(type of substance), a site investigation has been completed to determine the horizontal and vertical extent of contamination in the environment.

Proposed corrective action measures include _____ (technology or technologies to be used).

The Energy and Environment Cabinet proposes to accept the Corrective Action Plan. This decision is based on a thorough review of site conditions, Kentucky statutes and regulations.

Copies of the Corrective Action Plan are available from the UST Branch at the above address or by contacting the Records Custodian for the UST Branch at (502) 564-5981. Persons wishing to submit written comments on the Corrective Action Plan should direct them to the cabinet within thirty (30) days after publication of this notice.

Upon request, the cabinet will provide a copy of the Corrective Action Plan in an alternate format.

7.0 OTHER CONSIDERATIONS

- The owner/operator/contractor/consultant bears the responsibility of exploring, identifying and addressing all potential safety hazards throughout the course of their work.
- The cabinet reserves the right to require additional information. The owner/operator will be contacted, in writing, by the cabinet if more information is required.
- Refer to the Classification Outline, which is incorporated by reference in 401 KAR 42:080 for additional information.
- Refer to the Site Investigation Outline for more information regarding monitoring well requirements, data tables, proper sample collection and management, and trip blank requirements.
- Refer to Section 7 of the Site Investigation Outline for more information regarding decontamination and waste disposal or treatment at a permitted facility.
- If contamination above screening levels has been confirmed off-site, verify that any previously existing off-site access agreements are still valid.

8.0 REPORT CERTIFICATION

The Corrective Action Report Certification, DEP5040 shall be completed and signed by a P.E. or a P.G., and submitted for all reports associated with this outline.